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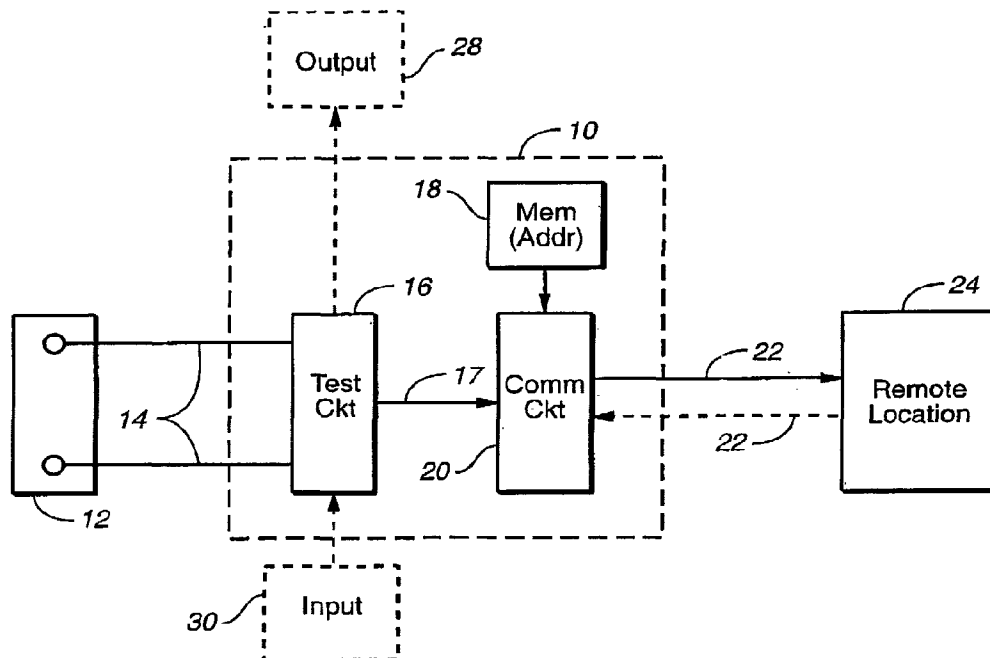
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(54) Title: **ELECTRONIC BATTERY TESTER WITH NETWORK COMMUNICATION**



(57) Abstract: An electronic battery tester (10) for testing a storage battery (12) includes test circuitry (16) configured to provide a battery test output (17) related to a condition of the battery (12). A memory (18) stores a battery tester address of the battery tester (10), and communication circuitry transmits the battery test output formatted with the battery tester address on a communication link to a remote location.



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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ELECTRONIC BATTERY TESTER WITH NETWORK COMMUNICATION

BACKGROUND OF THE INVENTION

The present invention relates to electronic
5 battery testers of the type used to perform tests on
storage batteries. As storage batteries have found
increasing use in various industries, the use of
electronic battery testers to test those batteries
has expanded. Example uses include batteries for
10 vehicles (with or without internal combustion
engines) and batteries for back up power supplies
such as those used in telecommunication
installations.

To address this increased use, various
15 diagnostic and testing techniques and systems for use
with storage batteries have advanced in recent times.
However, a typical electronic battery tester simply
provides an output which is viewed by a user or
technician. The data is used to make a determination
20 regarding the condition and possible need for
replacement of a storage battery. Once that
determination is made, the output from the battery
tester is typically discarded when the battery tester
is disconnected.

25 The increasing use of electronic battery
testers has resulted in an increasing number of battery
tests which are performed and consequently resulted in
an increased amount of data related to storage

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batteries. However, advantages from this increased amount of data has been largely unrecognized.

SUMMARY OF THE INVENTION

An electronic battery tester for testing a
5 storage battery includes test circuitry configured to couple to the storage battery and provide a battery test output related to a condition of the battery. A memory is configured to store a battery tester address of the battery tester. Communication
10 circuitry transmits the battery test output formatted with the battery tester address on a communication link to a remote location.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a simplified block diagram of a
15 battery tester in accordance with one example embodiment of the present invention.

Figure 2 is a simplified flow chart showing steps in accordance with one example embodiment of the invention.

20 Figure 3 is a simplified block diagram showing steps associated with retrieving data in accordance with one example embodiment of the invention.

Figure 4 is a simplified block diagram
25 showing steps in accordance with receiving battery test data.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention includes the recognition that the output from electronic battery

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testers can provide useful diagnostic or other information for analysis to a remote location. In one aspect, the present invention includes providing an electronic battery tester with a battery tester
5 address and transmitting the result of a battery test, data recovered the test during or from the battery, or related to the battery test, to a remote location in a manner in which the battery tester address is formatted (i.e., in some way combined or
10 associated with) with the battery test data. This information is transmitted to a remote location for subsequent review or processing. Similarly, the battery tester can receive information when the information is associated with the battery tester
15 address.

Figure 1 is a simplified block diagram showing an electronic battery tester 10 in accordance with one example embodiment of the present invention. Electronic battery tester 10 couples to storage
20 battery 12 through electrical connections 14. In one embodiment, connections 14 are Kelvin connections. However, the invention is not limited to such a configuration. The connection can be any type of connection including non-physical connections and can
25 comprise any number of connections. Electronic battery tester 10 includes test circuitry 16 which is configured to perform a test on battery 12 using any type of known or yet to be discovered battery test and provide a battery test result (or output) 17.

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A memory 18 contains a battery tester address associated with the battery tester 10. In some embodiments, the address is not unique. Communication circuitry 20 couples to the test
5 circuitry 16 and the memory 18 and is configured to format information related to the battery test (battery test data) along with the battery tester address on a communication link 22. Line 22 can, for example, couple to a remote location 24. The
10 communication link 22 can operate bi-directionally or in a single direction, carrying data between tester 10 and remote location 24. The link 22 can be a network, such as a computer network. Example network implementations include ethernet, token ring, PPP
15 (point to point protocol), SLIP, or other protocols including proprietary protocols.

Figure 1 also illustrates an optional output 28 which can be used to provide an output related to the battery test. Similarly, an optional
20 input 30 can be used to input data. For example, the data can relate to the type of battery 12 or be used in the determination of a relative condition of battery 12, for example by receiving a battery rating. The output 28 and the input 30 can be for use
25 by an operator, such as a display and a manual input, or it can be coupled to other equipment. The input 30 and output 28 can be over physical or non-physical connections. The various components of battery tester 10 including output 28 and input 30, can be

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implemented using any number of components and Figure 1 is provided to illustrate a simplified block diagram. With microprocessor based circuitry, the various blocks illustrated in Figure 1 may be implemented in shared components and their physical implementation may not break down into the discrete blocks illustrated in the Figure. The various components can be implemented in hardware, software or their combination.

Figure 2 is a simplified block diagram showing example steps in accordance with the present invention. The various steps shown in Figure 2 may be implemented in any order, or wholly or partially in parallel, and are not limited to the particular implementation shown in the Figure. At block 52, the process starts and control is passed to block 54 where the storage battery 12 is tested. At optional block 56, battery test data is obtained. This can be any data which is related to the battery test and may or may not include the battery test result obtained at block 54. At block 58, the address of the battery tester 10 is obtained from memory 18. At block 60, tester 10 formats the battery test data with the battery tester address. The formatted data is transmitted over communication link 22 at block 62.

The battery test performed at block 54 by test circuitry 16 can be any known or yet to be discovered battery test. In one aspect, the battery test is based upon a dynamic measurement, that is a

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measurement in which a time varying signal is used in performing the battery test. In another example aspect, electrical connections 14 comprise Kelvin connections.

5 The battery test output 17 can be any type of output from a battery test including a qualitative or a quantitative output. The optional battery test related data can be any type of data related to the battery test including various measurements used in
10 obtaining the battery test output (such as voltages, currents, information related to timing, time periods, signals and waveforms, etc.) or other types of data including temperature (either ambient or some other temperature such as the temperature of battery
15 12), battery serial number, model number, vehicle identification or serial number, geographic related information, time and/or date information, data which identifies the operator, the steps performed by the operator or the battery test, the vehicle VIN number,
20 data obtained from the vehicle computer or computer system, data related to the architecture of a backup or auxiliary battery site including the equipment, number of battery strings and types of batteries, maintenance related data, etc. The data can be
25 obtained from existing or yet to be implemented vehicle communication bus structures including the CAN bus, J1939, J1850, etc. Other types of data includes bar code information, dealer information, codes such as warranty codes, count information

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related to how many times or when a particular battery tester was used, information relating to promotions or sales, etc. Additionally, data can be a compilation of data collected over a period of time, either raw data or data which has been analyzed or otherwise used by the battery tester.

Figure 3 is a simplified block diagram 70 showing steps associated with the receiving of data by electronic battery tester 10 over communication link 22. The procedure starts at 72 and at block 74 the formatted data is received from bus 22. This formatted data is of a similar format to that discussed in connection with Figure 2 and contains information along with the address of the electronic battery tester 10. The formatted data is extracted and retrieved at step 76 and some type of action is performed at step 78. The particular type of action can be any type of action including actions in which the retrieved data is acted upon as a function of the retrieved data, stored in memory 18 for future use, immediately displayed or otherwise utilized by battery tester 10, etc.

Communication link 22 is any type of physical or non-physical communication link, or a combination. Examples include electrical wiring, infrared, Radio Frequency (RF), etc. The data carried on communication link 22 can be unidirectional or bi-directional and can be in accordance with any communication protocol. The data carried on

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communication link can be in an encrypted format in accordance with any encryption technique. In various aspects, the address of battery tester 10 can be a shared address, a locally unique address or a globally unique address.

One example protocol for data on link 22 is the TCP/IP protocol. In such an embodiment, the address of battery tester 10 can be an IP (Internet Protocol) address. For example, RFC791 promulgated by the Internet Engineering Taskforce in September 1981 defines such an address. In one specific example, the address consists of at least four groups of data, each group comprises at least 8 bits.

Data can be sent in response to an event at battery tester 10, at particular times, or in response to polling from remote location 24. If a two-way communication link 22 is used, data and/or programming instructions in tester 10 can be updated as desired and tester 10 can be controlled from a remote location.

Remote location 24 can collect data from one or more battery testers. The data can be placed into a database format for subsequent analysis. For example, statistics of the data can be calculated and used in order to diagnose or research battery failures, sales trends, usage, or other aspects related to battery tests, installation, use and ultimate failure. Additionally, data can be correlated with vehicles, geographical areas,

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dealers, etc., including how battery testers are being used.

When retrieving data, various types of information can be retrieved by electronic battery
5 tester 10. For example, battery test parameters or test criteria can be automatically updated as can tables or battery ratings. The battery tester software can be updated as desired as new releases become available. Service bulletins related to a
10 particular test, or particular type of battery, particular vehicle or problem associate with a battery or battery test can be provided to the operator or stored in the memory for future use. The test procedures for unusual cars, or tests which are
15 difficult to perform, can be looked up on a remote database. An authorization can be received in which the operator receives an authorization to replace a battery, for example a battery which is under warranty. The authorizations can be a function of
20 data contained at a remote location, for example if a particular location has an unusually high rate of warranty returns, a request for authorization to return a battery could be denied, or otherwise identified for subsequent auditing. The battery
25 tester 10 can also take advantage of increased computing power which might be available at a remote location. Data available over the internet can be retrieved for use during the test. For example, weather information or statistics can be obtained for

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a particular area such that the battery test is modified as function of the current or predicted weather. If a cold period is imminent, for example, a harsher test can be employed. If a battery is
5 replaced, an inventor list can be updated such that a inventory is reordered, for example, by sending an e-mail or other communication to a distributor. If the battery itself has a unique identification, for example a serial number, this information can be used
10 to monitor the battery from "cradle to grave". For example, various tests performed throughout the life of the battery can be utilized to observe trends in the battery test. Further, service alerts or other information can be linked to a battery.

15 Figure 4 is a simplified block diagram 100 showing steps performed in accordance with receiving data from an electronic battery tester in accordance with the present invention. The receiving can be, for example, at a remote manufacturing or management
20 site. At block 102 the procedure starts and control is passed to block 104 where a data pack is received from the electronic battery tester over the communication link. At block 106, the data packet is parsed into the address which identifies the
25 electronic battery tester and the battery test data contained within the data packet. At block 108, the battery test data is stored or otherwise operated upon. Various examples of such operations are discussed above.

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Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without
5 departing from the spirit and scope of the invention.

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WHAT IS CLAIMED IS:

1. An electronic battery tester for testing a storage battery, comprising:

test circuitry configured to couple to the storage battery and provide a battery test output related to a condition of the battery;

a memory configured to store a battery tester address of the battery tester; and

communication circuitry configured to transmit battery test data formatted with the battery tester address on a communication link to a remote location.

2. A method for testing a storage battery with a battery tester, comprising:

coupling to the storage battery and providing a battery test output related to a condition of the battery;

retrieving a battery tester address of the battery tester from a memory; and

transmitting battery test data formatted with the battery tester address on a communication link to a remote location.

3. The invention of claims 1 or 2 wherein the communication link comprises a physical connection.

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4. The invention of claims 1 or 2 wherein the communication link comprises a non-physical connection.

5. The invention of claims 1 or 2 wherein the communication link is in accordance with TCP/IP.

6. The invention of claims 1 or 2 wherein the address comprises an IP address.

7. The invention of claim 6 wherein the IP address comprises four groups of eight bits each.

8. The invention of claims 1 or 2 wherein the address comprises a unique address.

9. The invention of claims 1 or 2 wherein the communication link is bi-directional.

10. The invention of claims 1 and 2 wherein coupling to the battery is through a Kelvin connection.

11. The invention of claims 1 or 2 wherein the battery test is related to a dynamic parameter of the battery.

12. The invention of claims 1 or 2 including receiving a user input.

13. The invention of claim 12 wherein the battery test data includes data received through the user input.

14. The invention of claim 13 wherein the user input comprises a battery rating.

15. The invention of claim 13 wherein the user input comprises a battery type.

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16. The invention of claims 1 or 2 including displaying an output related to the condition of the battery.

17. The invention of claims 1 or 2 wherein the battery test data includes the output related to the condition of the battery.

18. The invention of claims 1 or 2 wherein the battery test data includes data used to determine the condition of the battery.

19. The invention of claims 1 or 2 wherein the battery test data includes data received from a bar code.

20. The invention of claims 1 or 2 wherein the battery test data includes data which identifies a dealer.

21. The invention of claims 1 or 2 wherein the battery test data includes a warranty code.

22. The invention of claims 1 or 2 wherein the battery test data includes count information.

23. The invention of claims 1 or 2 wherein the battery test data includes information related to a promotion.

24. The invention of claims 1 or 2 wherein the battery test data includes a compilation of data.

25. The invention of claims 1 or 2 wherein the battery test data is encrypted.

26. The invention of claims 1 or 2 wherein the battery test data is transmitted on the communication link at predetermined times.

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27. The invention of claims 1 or 2 wherein the battery test data is transmitted on the communication link in response to polling.

28. The invention of claims 1 or 2 wherein the battery test data includes a vehicle identification number (VIN).

29. The invention of claims 1 or 2 wherein the battery test data includes data retrieved from a data bus of a vehicle.

30. The invention of claims 1 or 2 wherein the battery tester retrieves test parameter updates.

31. The invention of claims 1 or 2 wherein the battery tester receives software updates.

32. The invention of claims 1 or 2 wherein the battery tester receives service bulletins.

33. The invention of claims 1 or 2 wherein the battery tester receives test procedures.

34. The invention of claims 1 or 2 wherein the battery tester receives battery replacement authorization.

35. The invention of claims 1 or 2 wherein the battery tester receives weather related information.

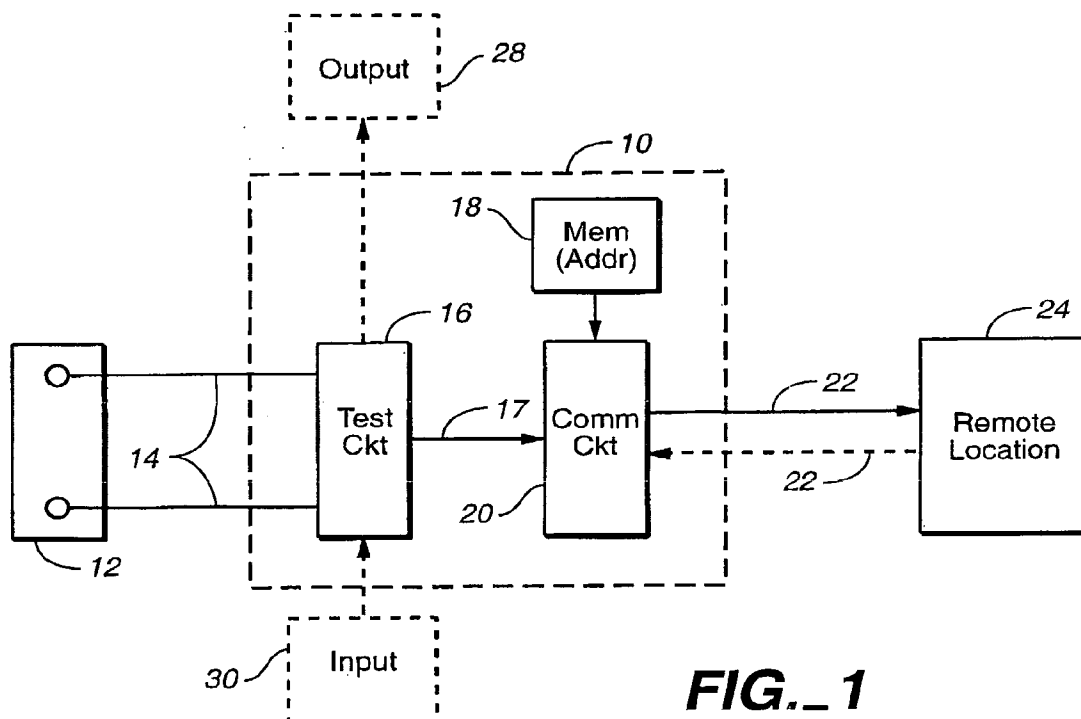
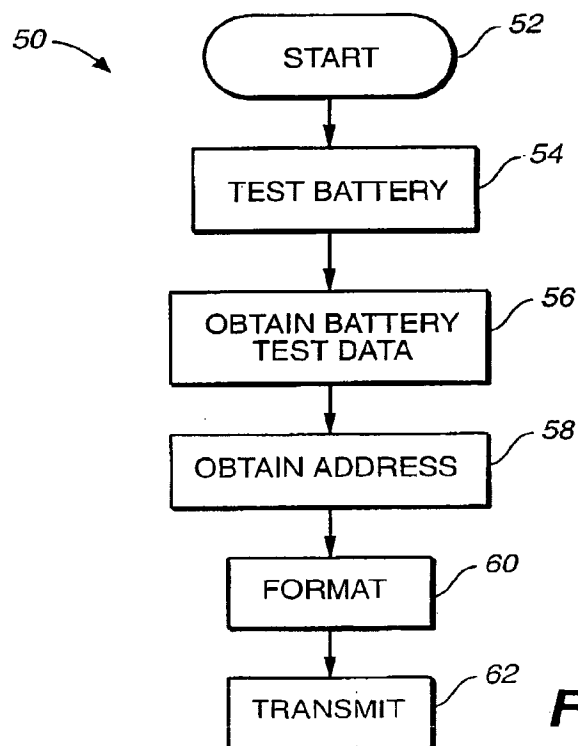
36. The invention of claims 1 or 2 wherein the battery tester receives information related to the specific battery under test.

37. A method for receiving battery test data from an electronic battery tester configured to test a storage battery, comprising:

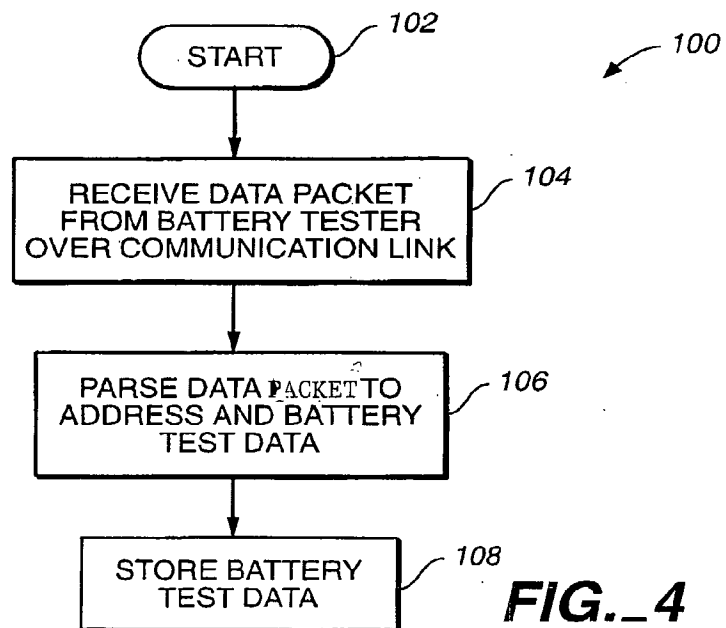
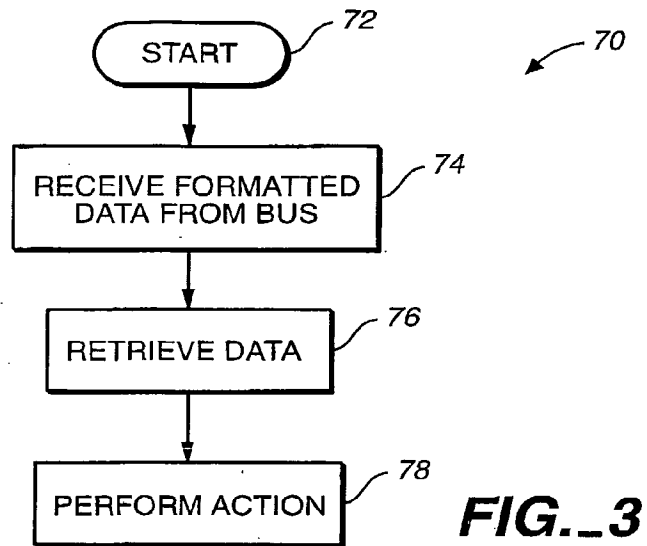
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receiving a data packet over a
communication link;
parsing the data packet into an address
which identifies the electronic
battery tester and into battery test
data provided by the electronic
battery tester; and
storing the battery test data.

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**FIG. 1****FIG. 2**

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 03/06577

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01R31/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X,P	US 2002/171428 A1 (BERTNESS KEVIN I) 21 November 2002 (2002-11-21) abstract; figure 1 paragraph '0001!; claims 1,36,70 ---	1-37
X	WO 00 67359 A (MIDTRONICS INC) 9 November 2000 (2000-11-09) page 1, line 3 - line 6 page 8, line 7 - line 34 page 10, line 8 - line 22 page 23, line 14 -page 24; claims 1,4,7,9,13,18; figure 1 --- -/--	1-37

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/06577

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A	<p>WO 00 62049 A (MIDTRONICS INC) 19 October 2000 (2000-10-19) page 2, line 4 - line 16 page 8, line 21 - line 23 page 13, line 14 - line 26; figure 1 page 14, line 19 - line 29 page 17, line 5 - line 9 page 27, line 16 - line 19 ---</p>	1-37
A	<p>US 6 263 268 B1 (TRANSCONTECH CORPORATION) 17 July 2001 (2001-07-17) abstract; figure 1 -----</p>	1-37

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